

Claims

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- [c1] 1 .A traffic signal ball comprising:
a lamp including:
a plurality of LEDs,
an optical element arranged to disperse forwardly directed light produced by the LEDs, and
a threaded electrical connector; and
an optical system that receives light dispersed by the optical element and forms at least a portion of the received light into an outwardly directed light beam.
- [c2] 2 .The traffic signal ball as set forth in claim 1 , wherein the optical system includes:
a parabolic reflector arranged to receive and substantially collimate at least a portion of light dispersed by the optical element.
- [c3] 3 .The traffic signal ball as set forth in claim 2 , wherein the optical system further includes:
a lens arranged to receive light collimated by the parabolic reflector.
- [c4] 4 .The traffic signal ball as set forth in claim 1 , wherein the optical system includes:
one of a filter and a tinted lens for spectrally filtering the light beam.
- [c5] 5 .The traffic signal ball as set forth in claim 1 , wherein the optical system includes:
an optical system adapted to operate with an incandescent light bulb.
- [c6] 6 .A method for retro-fitting a traffic signal lamp with a threaded LED light source, wherein the traffic signal lamp has a threaded light bulb, a threaded socket for receiving and powering the light bulb, and optics configured to direct light produced by the light bulb in a generally forward direction, the method comprising the steps of:
removing the threaded light bulb from the threaded socket; and
connecting the threaded LED light source into the threaded socket, wherein the threaded LED light source includes:

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a threaded electrical connector adapted for mechanical and electrical connection to the threaded socket,
at least one light emitting diode (LED),
a heat-sinking element for removing heat from the at least one LED,
electrical conditioning circuitry that receives electrical power from the threaded electrical connector and conditions the electrical power to operate the at least one LED, and
an optical element optically communicating with the at least one LED for distributing light produced by the at least one LED in conformance with the traffic signal lamp optics.

[c7] 7. The method as set forth in claim 6, further including:
prior to removing the threaded light bulb, opening a cover of the traffic signal lamp; and
after connecting the threaded LED light source, closing the cover of the traffic signal lamp.

[c8] 8. The method as set forth in claim 6, further including:
applying electrical power to the threaded LED light source via the threaded socket to produce white light emission from the LED light source.

[c9] 9. The method as set forth in claim 6, further including:
applying electrical power to the threaded LED light source via the threaded socket to produce one of red light emission, yellow light emission, and green light emission from the LED light source.

[c10] 10. A light-emitting diode-based light source for retro-fitting into a traffic signal lamp employing an incandescent light bulb, the light-emitting diode-based light source comprising:
at least one light emitting diode (LED);
a reflector cooperating with the at least one LED to adapt light produced by the at least one LED for receipt by optics of the traffic signal lamp; and
a screw-type electrical connector adapted to mate with a threaded socket connector of the traffic signal lamp, the screw-type electrical connector adapted to transmit electrical power to the at least one LED.

- [c11] 11. The light-emitting diode-based light source as set forth in claim 10, further including:
a heat sink for controlling heat generated by the light-emitting diode-based light source.
- [c12] 12. The light-emitting diode-based light source as set forth in claim 10, wherein the reflector includes:
a light-transmissive encapsulant surrounding the at least one LED and having a surface defining the reflector shape; and
a reflective material arranged on the surface defining the reflector shape.
- [c13] 13. The light-emitting diode-based light source as set forth in claim 12, wherein the surface includes:
a depression arranged above the at least one LED.
- [c14] 14. The light-emitting diode-based light source as set forth in claim 12, wherein the reflective material includes:
a partially light-transmissive material arranged to allow partial light transmission through the reflector.
- [c15] 15. The light-emitting diode-based light source as set forth in claim 12, wherein the reflective material includes:
a metallic coating of high reflectivity applied to the surface.
- [c16] 16. The light-emitting diode-based light source as set forth in claim 10, wherein the at least one light emitting diode emits white light that cooperates with a tinted optical element of the traffic signal lamp to produce a selected light color.
- [c17] 17. The light-emitting diode-based light source as set forth in claim 10, wherein the at least one light emitting diode emits one of red, yellow, and green light.
- [c18] 18. The light-emitting diode-based light source as set forth in claim 10, wherein the at least one light emitting diode cooperates with a masking filter to define a selected light output shape.

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- [c19] 19. An LED-based light source comprising:
 - a threaded electrical connector arranged to receive electrical power;
 - power converting electronics that receive the electrical power and convert the electrical power to converted power;
 - a plurality of LEDs arranged to receive the converted power, the LEDs producing a generally forwardly directed first light beam responsive to receipt of the converted power;
 - a light dispersing element arranged at a focal region, the light dispersing element intercepting and transforming the first light beam into dispersed light emanating from the focal region; and
 - an optical system arranged to focus dispersed light emanating from the focal region into an output light beam having selected beam characteristics.
- [c20] 20. The LED-based light source as set forth in claim 19, wherein the optical system includes:
 - a collimating reflector arranged to substantially collimate dispersed light emanating from the focal region; and
 - a lens arranged to receive the substantially collimated light.
- [c21] 21. The LED-based light source as set forth in claim 20, wherein the threaded electrical connector, the plurality of LEDs, the light dispersing element, the collimating reflector, and the lens comprise a unitary threadedly connectable light source.
- [c22] 22. The LED-based light source as set forth in claim 19, further including:
 - a heat sinking means for controlling heat generated by the light-emitting diode-based light source.
- [c23] 23. A lamp for use in a light producing apparatus having a socket through which power is supplied to the lamp, said socket holding the lamp, and an optical system including a reflector and a lens which cooperate to direct light outwardly from the light producing apparatus, said lamp comprising:
 - a connector by which the lamp is installed in the socket;
 - a number of LEDs electronically connected to the connector; and
 - a redirection element arranged to redirect light emitted from the number of

LEDs such that the redirected light is coupled into the optical system of the light producing apparatus.

[c24]

24 .The lamp as set forth in claim 23 , wherein the connector is a threaded connector adapted to screw into the socket.

[c25]

25 .The lamp as set forth in claim 23 , wherein the connector, the LEDs, and the redirection element comprise a single mechanically rigid apparatus.

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